PILE LAYOUT TO MINIMIZE INTERFERENCE

EXAMPLE 2
EFFECT OF PLACEMENT AND ALIGNMENT TOLERANCES ON INTERSECTION PROBABILITY

1. Purpose

The purpose of this example is to illustrate the possible effect of varying placement and alignment tolerances on the probability of intersection for a single pile.

2. Placement Tolerances

The program default standard deviation values for the pile butt ground location errors, $\sigma_{\Delta x}$ and $\sigma_{\Delta y}$ (SIGMAX and SIGMAY in the program CPGP), are 1.5 in. each. As the typical tolerance for pile butt location is 3.0 in., the normal tolerance corresponds to two standard deviations. The effect of changing the standard deviations over the range 0.5 in. to 3 in. was evaluated by making a parametric study involving 18 runs of the program. If the tolerances are assumed to correspond to two standard deviations for each case, implying that contractor tightens or relaxes control over pile placement consistent with the specified tolerances, then the parametric study reflects placement tolerances of 1.0 to 6.0 in. The results of the study are shown in Figure 5-1 where the probability of intersection is plotted against SIGMAY for three values of SIGMAX. The heavy line in the figure corresponds to the case of equal standard deviations in both directions. All points were obtained using the program default values for other parameters; i.e., a 14-in. diameter pile 80 ft long, with SIGMAP = 0.15 in./ft and SIGMAB = 0.10 in./ft. For the cases analyzed, it is observed that there is a slight increase in the probability of intersection with increasing standard deviation, but the variation is within one-half an order of magnitude. The example suggests that the probability of intersection is not greatly affected by the degree of precision in the ground location; as the standard deviations (and possibly tolerances) increase, there is an increasing chance of the piles being both closer together and further apart.

3. Alignment Tolerances

The program default standard deviation values for the pile alignment errors, $\sigma_{\Delta p}$ and $\sigma_{\Delta b}$ (SIGMAP and SIGMAB in the program), are 0.15 in./ft and 0.10 in./ft, respectively. As the typical tolerances for pile plumb and batter are 0.25 in./ft, the normal tolerances correspond to 1.67 and 2.5 standard deviations, respectively. The effect of changing the standard deviations over the range 0.01 to 0.35 in./ft was evaluated by making a parametric study involving 21 runs of the program. The results of the study are shown in Figure 5-2 where the probability of intersection is plotted against SIGMAB for four values of SIGMAP. The heavy line in the figure corresponds to the case of equal standard deviations in both directions. All points were obtained using the program default values for other parameters; i.e., a 14-in. diameter pile 80 ft long, with SIGMAX = SIGMAY = 1.5 in. It is observed that when the standard deviations are assumed to be equal, the probability of intersection is very sensitive to the standard deviation of the alignment error, varying almost three orders of magnitude as the standard deviations are varied from 0.01 in./ft to 0.35 in./ft. Thus, the probability of intersection is implicitly sensitive to the alignment tolerance and quality of inspection of the vertical alignment. This example suggests that the probability of intersection can be greatly affected by the degree of precision in setting and checking the pile verticality or deviation from theoretical batter.

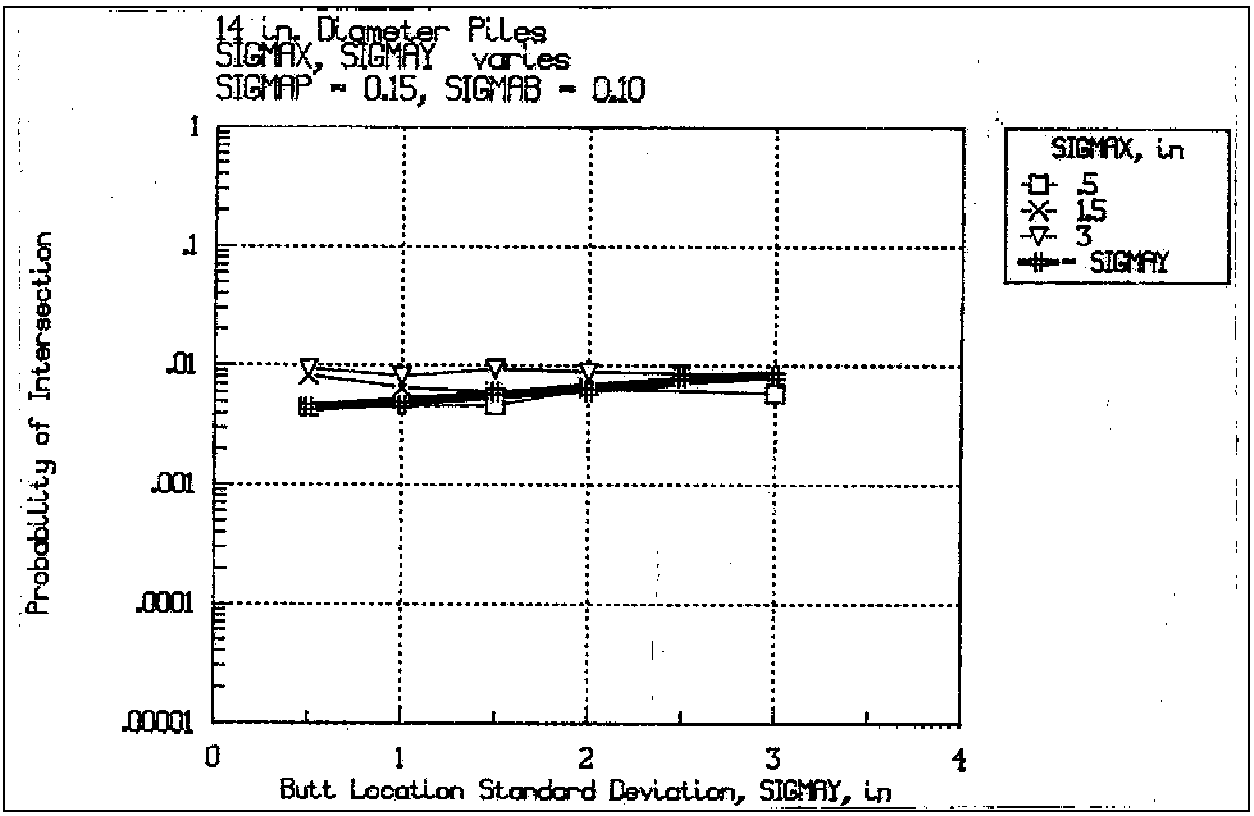

Figure 5-1. Effect of placement error on intersection probability

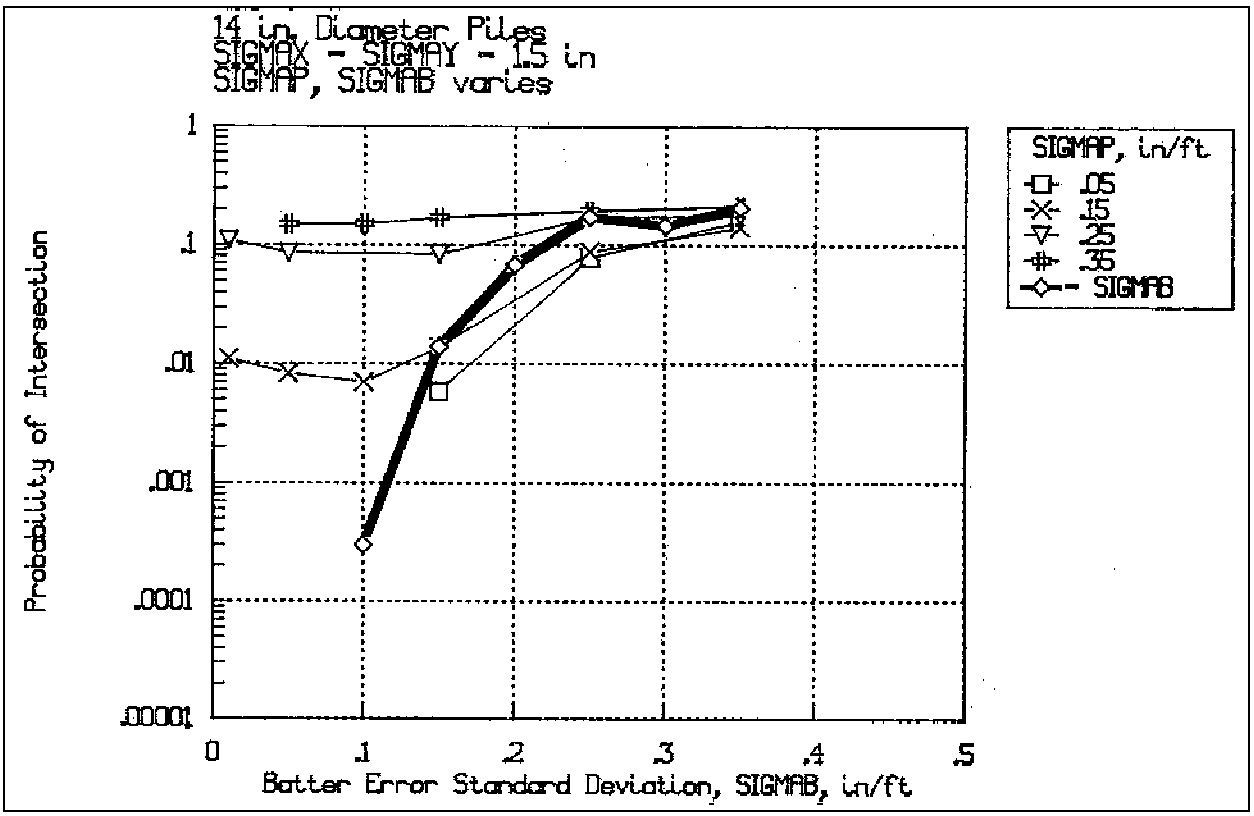

Figure 5-2. Effect of plumb and batter error on intersection probability